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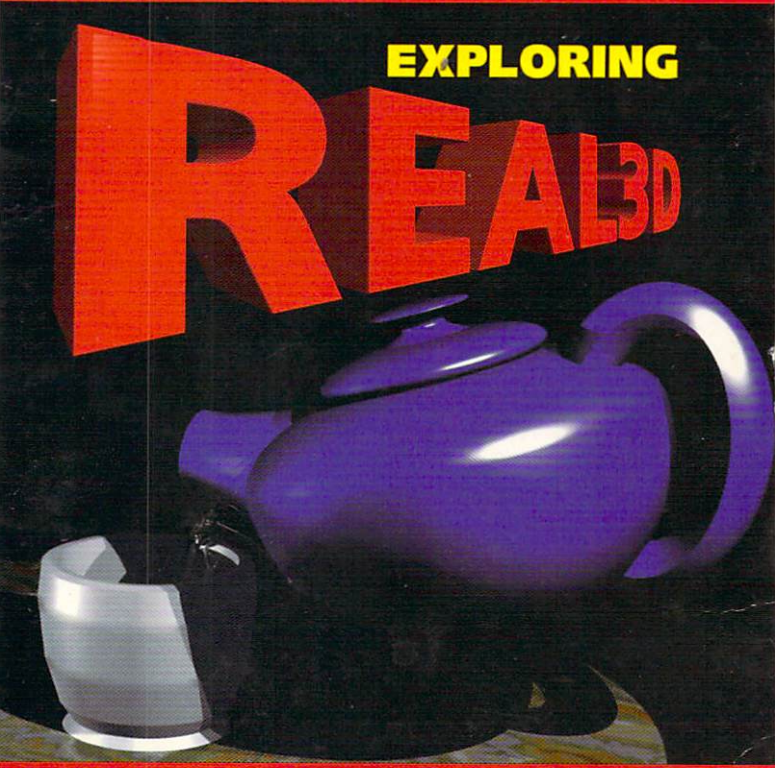
EXPLORING REAL 3D



Your essential guide to 3D modelling

Exploring

by Andy Jones and Nick Veitch

INFORMATION

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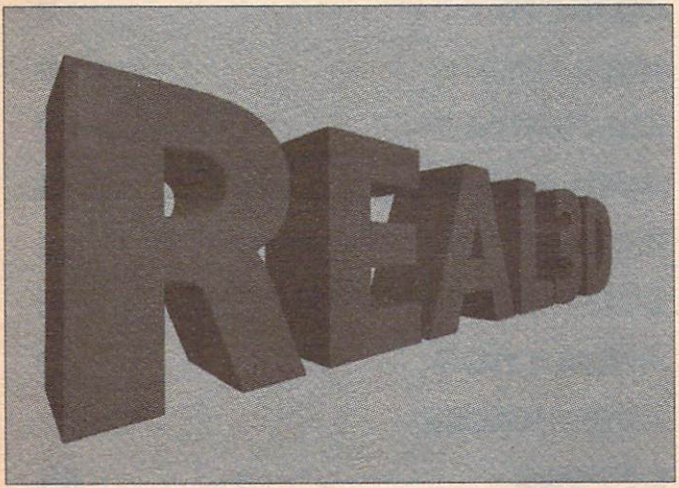
Welcome to our humble little book, which over the coming pages will act as your guide to exploring the tremendously powerful rendering engine you will have found on this month's coverdisk.

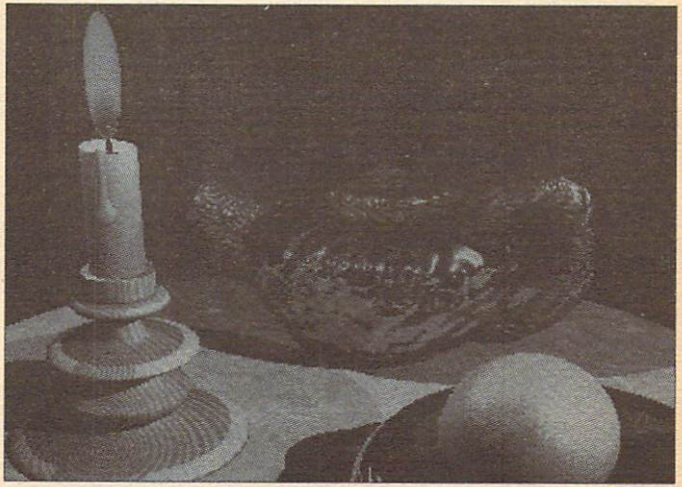
If you have found this tome in a dentist's waiting room or on the top deck of the Clapham Omnibus, you may be



Once you have text as an object, there are a variety of impressive effects you can generate.

wondering what is going on. This book is meant to accompany the REAL 3D coverdisk, comprising the complete software for REAL 3D 1.4.

The software will allow you to create just about any object you can imagine, put it in a scene and render it as a high quality 24-bit image. You can even animate your images to



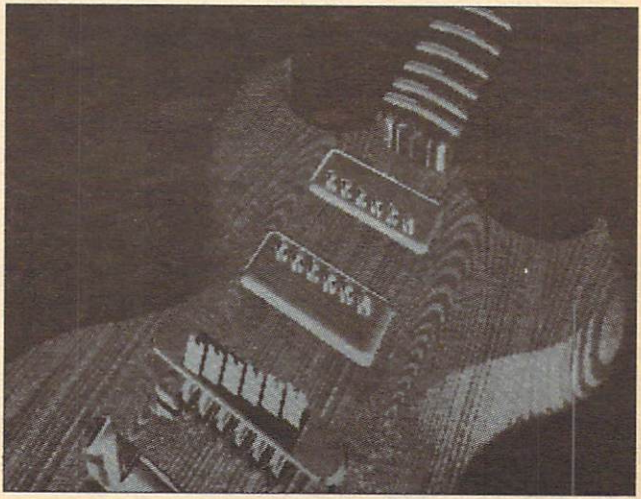
This sample picture, the objects and the scene that created it are all contained on your Amiga Format coverdisk.

create impressive opening titles for your home movies, or even interesting features in their own right.

Of course, to be able to do any of this you must understand how the software works. Thankfully, REAL 3D is fairly easy to pick up and use, but to help you along in your journey through all things 3D, we have put together hints, tips and examples of all the major features of the software.

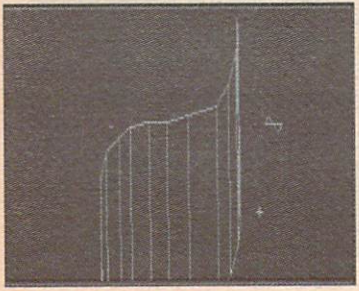
I hope you enjoy your early Christmas present from Amiga Format and Activa. Now lets get exploring...

Objects



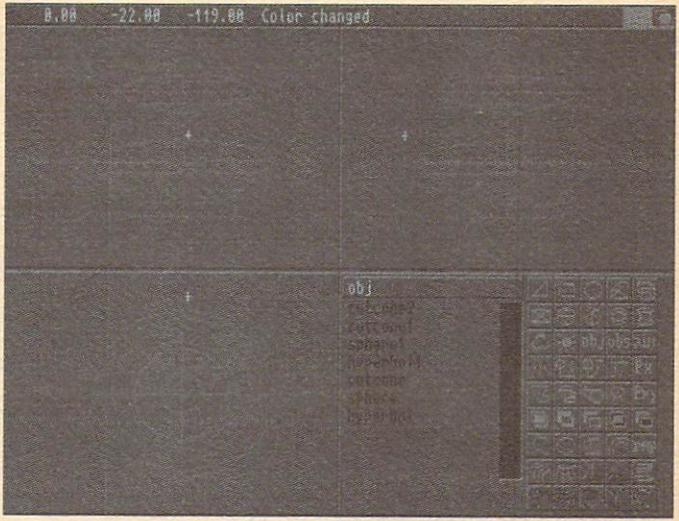
Obviously, in order to render three realistic three dimensional images, you first need to create the objects which are going to feature in your picture or animation. The objects are the very guts of rendering software – if you can't easily create the ojects you wish to appear in your virtual world, you aren't going to get very far at all. Fortunately for you, REAL 3D has very sophisticated modelling tools, primitives and operators, which will enaable you to create just about anything you can imagine. This chapter will show you how to take advantage of REAL 3D's excellent features.

REAL 3D has two main types of object. CSG Primatives and Meshes based on polygonal lines.



Meshes are simple to create and are very useful for representing organic objects.

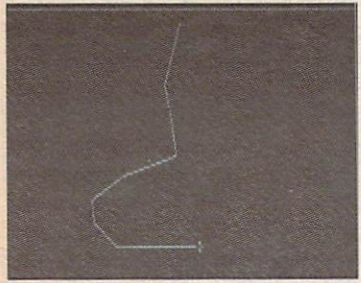
CSG Primatives (CSG stands for Constructive Solid Geometry) are a collection of commonly used objects such as spheres, cubes, polyhedrons, cylinders, etc. CSG objects are different from most other 3D programs in that they aren't made up of lots of



Solid, mechanical like objects can be built up using primitives or generate using one of REAL 3D's tools, such as the Lathe.

triangles joined together to form an object. Instead REAL 3D sees them as the mathematical formula for the object which means they are very quick to render and are always perfectly curved. This does lead to some limitations though. To start with you can only perform certain modifications to them, stretching, rotating, etc work but you can't, for

example, pull a point on the object away to form a bump. A CSG object has to maintain its basic nature, one end of a cube can't be rotated, only the entire cube.



A simple way to generate a mesh is to first dra a curve.

Now chose the Rotation tool and define the axis with the mouse.

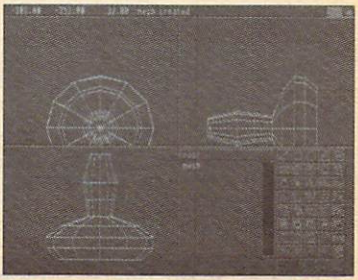
Meshes are formed in several ways, by connecting a series of lines, sweeping one curve along another, or by rotating one curve around another. The object created by these techniques is a hollow surface or skin. The object is made up from triangles and can be shaded to appear smooth. This kind of object is better suited to more organic shapes whereas CSG are ideal for more mechanical objects. The combination of the two provides perfect blend for almost any type of object.

CREATING OBJECTS

Primative creation in REAL

3D consists of two main parts, regardless of the primative being created. The first input for any object is for the centre or first corner of the object. The second stage actually defines the object and may require more than one click of the mouse depending on the object type. For example a polyhedron can have unlimited sides and the right mouse button is used to finish the creation, the same is true of the line and tube drawing tools. Objects such as cubes, spheres and cylinders only need two inputs, the centre or first corner and then the radius or second corner. One thing to remember when creating objects is that REAL 3D doesn't use dragging to size objects, each point is defined with a click and the mouse is moved to the next point,

Indicate via the requester how many sections you would like.



Presto – you have one rather excellent mesh object to play with.

clicked, and so on. Mouse dragging is used for a different aspect of the modelling process...

DRAG BOXES

Any object in a view window has points wherever there is a change in direction of the wireframe. A cube has points on every corner, a sphere has 36 points, 12 on each of the 3 circles that consist of the sphere's wireframe. These points can have a box dragged around them using the mouse., for example. Create a few objects in a view window. Try dragging around the points on these objects - to 'drag' click and hold the left mouse button and you will see a 'drag box' form. When you let go of the mouse button REAL 3D will place the cursor at the middle of all the points inside the drag box. Drag boxes can be used at any time during creation or modifications.

EXAMPLE Aligning a sphere and a cylinder.

- Create a Cylinder in the Front view.
- In the side view drag around the right-hand edge of the cylinder. This will place the cursor at the front of the cylinder.

In the front view create a sphere in the following way:

- To define the centre drag a box that encloses the

entire cylinder.
- To define the size drag a small box that just encloses the point of the cylinder at the top.

Pretty soon you will be able to make objects like this with ease.

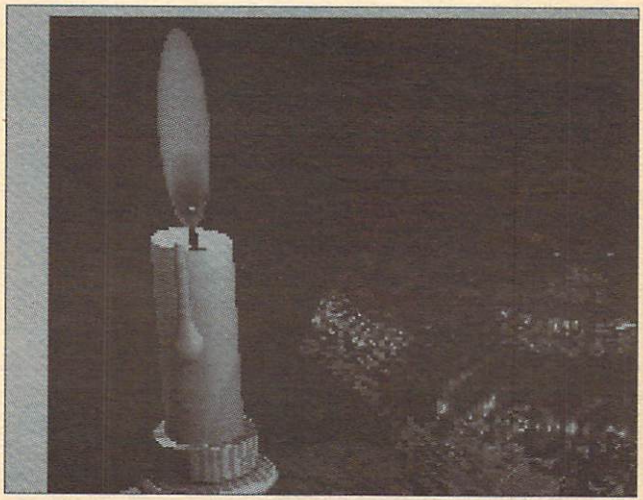
If you now go to to the wireframe screen and take a 45 degree view of the scene and then render you should be able to see that the sphere is perfectly aligned with the cylinder. No matter how much you zoom in you won't be able to see a join, well assuming the dragging worked!

REAL 3D has a couple more tricks for dragging operations. There are two keys that can be used immediately before a drag, "/" and "=". The "=" key is used when you want REAL 3D to only consider the points from the currently selected object. This comes in useful when a scene becomes more complex and the wireframes from other objects may be overlapping and make the drag difficult. The "/" key tells REAL 3D to use a 3D average of the points instead of the default 2D.
In the example above if the "/" key had been pressed

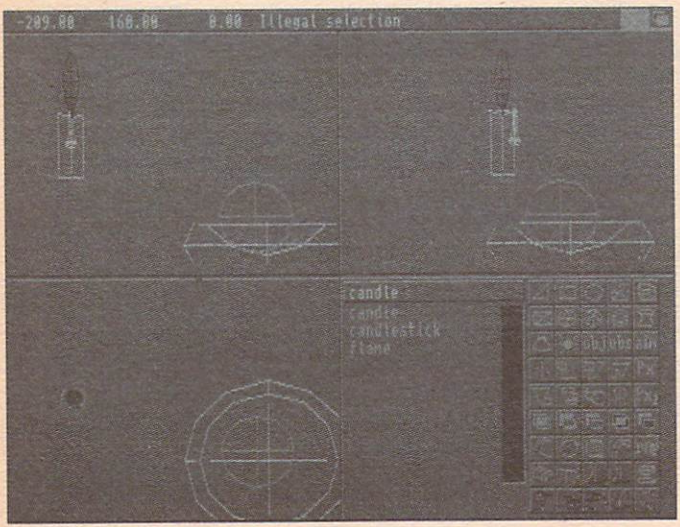
before the drag used to define the centre of the sphere then the sphere would have been created at the middle of the cylinder, not at the end.

More key commands are described in Appendix 1 of this book.

Hierarchy



Objects in REAL 3D are constructed hierarchically. This means the they are organised in a very natural way, for example: A fish lives in a pond, which is in a forest which is in a country which is on the earth which is in the solar system and so on. If the country was moved then so would the forest and therefore the pond and therefore the fish.



Notice how te candle in the demonstration scene is one object at the root level, but is actually made up of several parts.

This is how the hierarchy works. Any object can be part of the whole and so modifications, animation, or anything else that affects the whole would therefore affect all the parts that make up the whole. When a scene is built in REAL 3D initially only a root level exists and anything that is created will be placed inside the root level. When creating a scene remember to think about the hierarchical structure of the objects as you build them, for example:

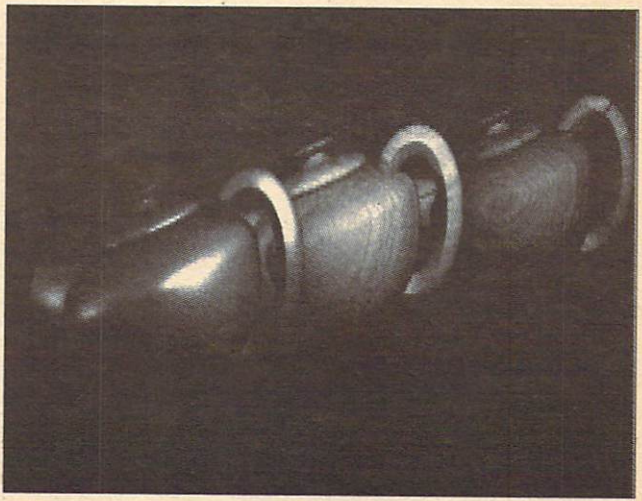
ROOT
- **SKY**
  - **SUN**
  - **CLOUDS**
  - **RAINBOW**
- **GROUND**
  - **GRASS**
  - **TREES**
  - **HILLS**
- **HOUSE**
  - **WALLS**
  - **WINDOWS**
  - **GARDEN**
    - **FLOWERS**
    - **SWIMMING POOL**

The structure above shows a natural layout for the scene.

Creating and animating complex objects is all but impossible without hierarchy.

The SKY, GROUND, and HOUSE are all seperate elements inside the ROOT level. This means moving the house to a new place would only involve selecting the HOUSE object and performing the move. If the WALLS, WINDOWS, and GARDEN were all just placed inside the ROOT level the move operation would have to be done three times, once for each object.

Materials



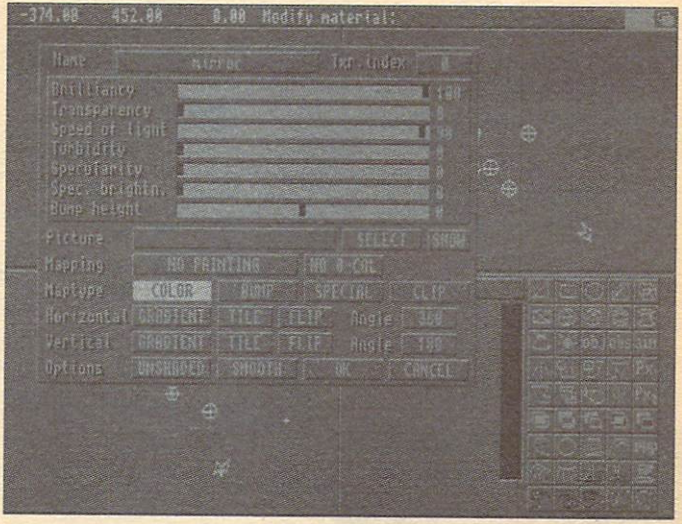
Creating photorealistic objects isn't just about making them the right shape. Many similarly shaped objects in the real world throw back light in a completely different way, like an orange and a ball-bearing. To properly model objects, these properties of different types of surface must be modelled too. Real 3D does this by using Materials.

REAL 3D's materials consist of two main aspects, surface properties and textures. Surface properties are items such as how brilliant (reflective) or transparent an object is. Textures are image files that are wrapped onto the object for colour, bumpmaps, etc.

To create a new material you first need to open the material window by selecting Project>Materials from the menus.

NAME
Click on this button to name a new material or to select an existing one.

TXTR. INDEX
This button is used to define the total number of frames used in a texture sequence. The format for the filename is as follows: frm0, frm1, frm2,,,,frm99,,,,frm546, etc. If the txtr index is greater than 0 then REAL 3D will automatically append the current frame number to the filename when



Each material has different values of certain attributes, which represent their light altering properties.

the scene is rendered. The software will cycle through the frames it finds until the animation is finished.

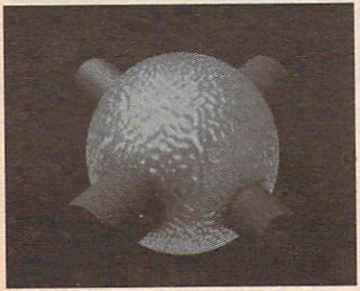
BRILLIANCY

This is a surface property which defines how reflective the material is. The higher the setting the more reflective the

material will be.

TRANSPARENCY
This slider defines how much light is transmitted through the object. Don't confuse transparency with how 'see through' the object is. To make a glass material you need to use Brilliancy as well as transparency, transparency on its own can be used for making materials like paper.

SPEED OF LIGHT
This defines the refraction index of the material. A value of 100 is the same as air, the lower the value the more the light will be bent. A value of around 64 is good for glass. Because REAL 3D deals with refraction properly, and as it is a solid modeller, you can even construct a working lens object.



Turbidity may not be good for pure glass, but it's excellent for liquids or ice.

TURBIDITY
Defines how foggy the material will be, or how much the light is randomly scattered while its inside an object. The higher the setting the more 'foggy' the material is.

SPECULARITY
Defines the how sharp specular reflections will be on the surface of the object. The higher the values the smaller and sharper the specular highlights.

SPEC. BRIGHTN.
Used in conjunction with Specularity to define how bright the specular highlights appear. Note that the actual brightness of the highlight ultimately depends on the colour of that object at any given point. If an object is completely black then the highlights will never appear as all light hitting the object is absorbed.

BUMP HEIGHT
Defines the maximum bump height to be used when creating a bumpmap.

PICTURE
Path and filename of a picture to be used for colour, bump, or special mapping. Note that REAL 3D Classic only supports 2,4,8,16,32, 64 (EHB) and HAM colour images - it will read images created in AGA screen modes but the image will be rendered incorrectly. The Select and Show buttons do exactly what they say, let you select and view the IFF image being used as a texture.

MAPPING
Specifies the type of mapping to be used.
Parallel – the mapping uses a rectangle proportional in size to the IFF image.

Cylinder – The image is wrapped around a cylinder, the X direction goes around the circumference and the Y direction travels along the length of the cylinder.

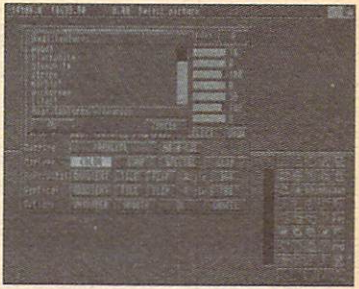
Sphere – Similar to cylinder mapping, but the top and bottom are 'pinched' in to create a sphere.
Default - This mapping has no shape so it only makes sense to use it with materials that do not use a texture, such as glass, chrome, etc.

NO 0 COLOUR.
The first colour in the image map's palette is treated as transparent and so the objects base colour will be visible through any parts of the image with colour 0.

MAPTYPE
Colour – Set this button to use the IFF to define the colour of the object

Bump – Set this button to make the material a bumpmap. The height of the bumps depends on the red value of the

IFF image, the more red the higher the bump.



Selecting a picture is easy, and REAL 3D will even display it for you too!

Special – This is a special type of mapping that defines a different property from each colour component. Red defines the bump height, Blue defines Brilliancy, and Green defines Transparency. Special mapping means you can have a single material define all three properties to create some very unique effects.

Clip – This allows the IFF to 'cut' away parts of the object the material is applied to. The No 0 Colour button has to be set for Clip mapping to work. When active any part of the IFF that is colour 0 will be removed from the object. A simple example would be a mesh fence. Rather than building thousands of individual objects to make the fence a Clip map could be used to 'cut' the holes into a simple rectangle.

GRADIENT

When an IFF is used for colour mapping you may notice

that as you move close to the object the IFF starts to become pixelated or chunky. This happens because the way the image is being mapped onto the object and the size and/or closeness of the object means the IFF is in effect being enlarged.

To prevent this happening REAL 3D can detect these situations and instead create a gradient from one pixel to the next in the image map. This smooths out the pixels but will soften the image slightly. The gradient is a good way of making smooth colour gradients, e.g.. Create a 1x2 pixel image, the top pixel being white, the bottom one black. Use this image in a material with Vertical gradient and apply it to a rectangle. Render the rectangle so that it nearly fills the screen and you will have a perfect gradient.

If you don't want your texture maps to pixellate in close-ups, use gradient.

TILE, FLIP, AND ANGLE

These three settings control exactly how the image map is wrapped onto objects. Tile tells the images to tile infinitely instead of the default once.

Flip will mirror the image every time it is tiled. This means the images doesn't have to have each side

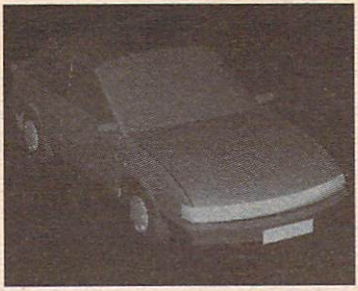
matching the other in order to have seamless edges when tiling.
Angle defines how many degrees the image is wrapped around before it tiles when using Sphere or Cylinder mapping. When using cylinder mapping only the first angle is used, Sphere uses both.

UNSHADED
When active Unshaded tells REAL 3D not to perform any shading calculations on this material. The colour of image or the object will remain at full brightness regardless of lights and shadows.

SMOOTH
When set surface reflections will be removed from any glass-like objects. A glass material will no longer have reflections. Smooth is often used with turbidity to create fogs.

LIGHTS
There is no limit to the number of lights sources or their colour. By default REAL 3D will use auto-exposure when rendering. This mode calculates the amount of light falling at the origin (0,0,0) and then scales the brightness of all lights to keep the origin correctly lit. This has some disadvantages though, imagine a scene of a car driving through a city at night. As the car gets nearer it's lights will

be casting more and more light on the origin. As this happens REAL 3D will make them darker and darker in order to maintain a constant light level for the scene. Obviously this is incorrect and so auto-exposure can be turned off.



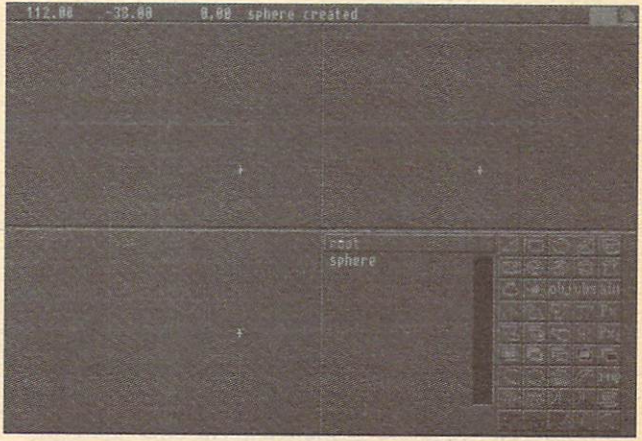
Car headlights could be a problem if you use the Auto Exposure option.

Doing so gives you full control over the lights, to change the brightness of a light simply change it's colour. When the car moves now its lights will no longer be affected and the scene will be correctly lit. Working without auto-exposure can be tricky but here's a couple of tips that will help.

• If the scene is too bright try making it bigger by selecting the root level and re-sizing it. This increases the distance the light has to travel and in effect reduces the brightness. The reverse is true is the scene is too dark.

• The colour of a light can be above 15, up to 100 in fact so if a light isn't giving enough light you can always increase it's brightness.

Boolean Operations



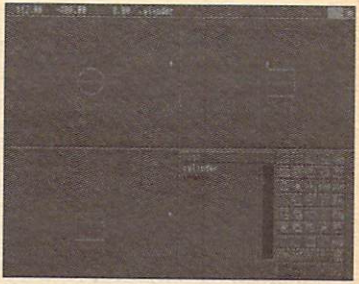
You may have come across the term Boolean Operator in a maths class at some stage, if you were paying attention. If you were, you will be able to understand REAL 3D's Boolean funtions ever so much easier.

Boolean operations all work in the same way but have very different results. Two objects are needed for any boolean, the target object and the tool. Imagine drilling a hole (tool) into a table top (target). The drill could be, for example, a cylinder and the table a cube. To cut the cylinder out of the cube you would do the following:

- In the top view window create a cube.
- In the front or side view use stretch to change the height of the cube so it represents a typical table top.
- In the front or side view position the cursor so it is just below the table.
- In the top view create a cylinder, this will be the hole.
- With the cylinder selected, choose Modify/Boolean/AND NOT from the menus.
- The Select window will now ask for an object so select the cube and click on OK at the bottom of the select window.

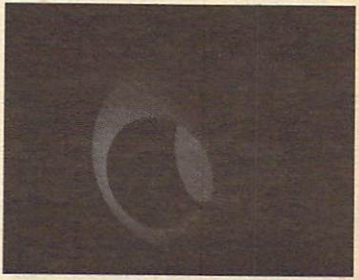
The Boolean AND NOT is now complete. Now delete the cylinder (by selecting it and using the "d" key) – if you render the cube you will see that it now has a hole where

the cylinder was. You may also notice that the colour of the cube has changed in the select window. This shows that it is a Boolean operation.



Here, a sphere primitive and a cylinder are processed with AND NOT.

The next form of boolean operation is AND. While AND NOT allows you to cut objects AND will combine objects so that only the overlapping parts of the two are visible. One example would be a dice which is in effect a cube with rounded corners:



The result is a sphere with a cylindrical hole – the beginnings of a bowling-ball?

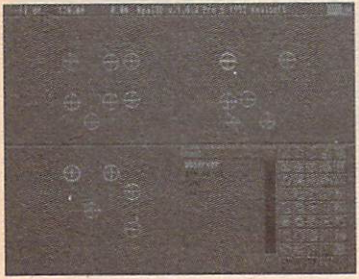
- Using the grid create a perfectly square cube.
- Create a sphere centered in the middle of the cube but make the radius slightly less than that of the cube.
- With the cube selected choose Modify/Boolean/AND

from the menu, or using the icon.

- Select the sphere and complete the operation.

Again the colour of the object in the select window will change to show the object is a boolean. Render the scene to see the final effect. Remember to delete the "tool" object after the operation, otherwise it will appear in the rendered scene too – you should always put your tools away.

To create the circles on the dice, you could use a spherical primitive to AND NOT away holes on the cube's surface. This could also save you a lot of effort, because if you make the sphere tool white, and use the AND NOT with Paint operator, you will save yourself the bothe of having to paint the dots on.



Dice objects are fairly simple to create with a few Boolean operations.

These are both very simple examples of boolean operations but the principal is the same for more complex objects.

CONTRUCTING COMPLEX OBJECTS

Unfortunately the space in this book doesn't allow for a complete tutorial of building a complex scene so instead here are some tips and guidelines to help you with the creation process.

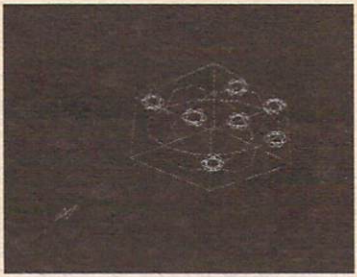
Use the hierarchy - remember to use a logical structure of levels when creating objects. This is especially true if the scene is going to be animated.

Break the object you are constructing into smaller pieces. The smaller the sections, the easier it will be to build. Most objects can be constructed with fewer objects when boolean operations are used well. Here are a couple of good examples:

• Use the lathe tool to create the profile of the guitar and then boolean AND it with a cube that surrounds the entire profile but is thinner. The result will be an object with a flat front and back but with bevelled edges for the guitar shape.

• Boolean AND a cutcone and polyhedron to create the tip of a screwdriver. The polyhedron is wider than the cutcone but not as tall so the final shape is a flat surface that rounds off at the edges.

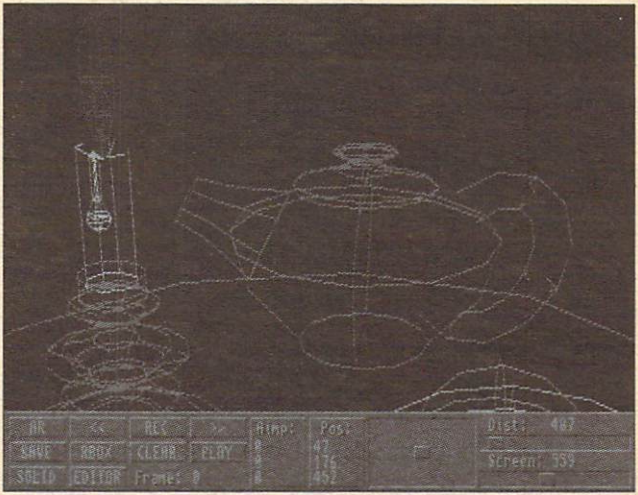
Try to build as much of the object as possible before applying any materials. This means you won't need to re-apply the materials if the object has to be modified or even re-built.



Notice of the wires from the AND NOT parts are still visible.

When you haven't a clue where to start, try thinking of how the object is constructed in real life. You already have a lathe, and the Boolean Operations are your milling machine – you should be able to build just about anything.

Wireframe


AR
<<
REC
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Rimp:
Pos:
Dist: 467
SAVE
RBOX
CLEAR
PLAY
Screen: 359
SOLID
EDITOR
Frames 0

The wireframe screen gives interactive control over the camera through an easy to use interface.
The main gadgets are:

Aimp. – X, Y, Z coords of the aimpoint, where the camera is looking.

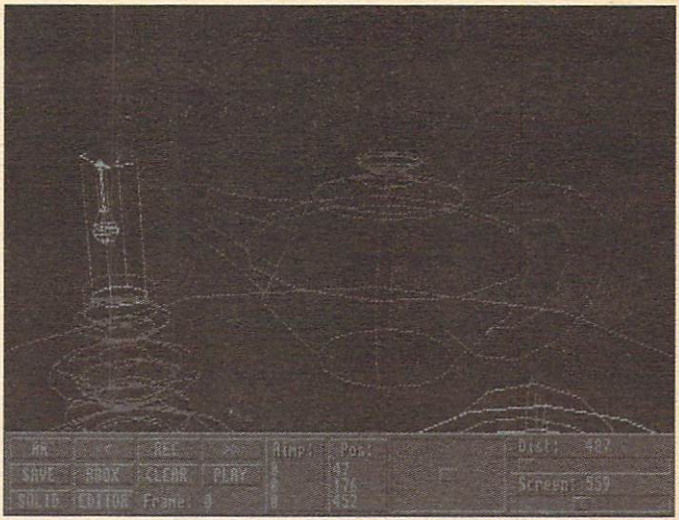
Pos. – X, Y, Z coords of where the camera is currently located.

POSITION GADGET.
The largest box with a button in the centre, to the right of the camera coordinates can be used to move the camera interactively. Clicking and holding the mouse on the button in the middle allows the view to be rotated in realtime. The view is always rotated around the aimpoint.

Distance – Defines the distance between the aimpoint and observer and adjusts the perspective.

Screen – Allows the size of the image to be scaled.

AR – Automatic Recording. If active all changes made to the aimpoint or observer are recorded. Each time a new change is made the frame number is increased. This makes creating a manually sequenced animation a whole lot easier, not to



The AR button will automatically record any changes you make and advance to the next frame – indispensable.

mention faster.

>> and << – Animation controls for stepping through frames.

REC – Saves the current settings to the aimpoint and

observer. If you don't press this button, all the changes you make are lost when you leave the Wireframe environment.

SAVE. Allows the wireframe screen to be saved as IFF images. To do this define a suitable name in the Solid Screen but add a _w postfix. Activate the SAVE button and click on PLAY.

RBOX – Turns on bounding boxes for all objects in order to speed up the screen refresh rate.

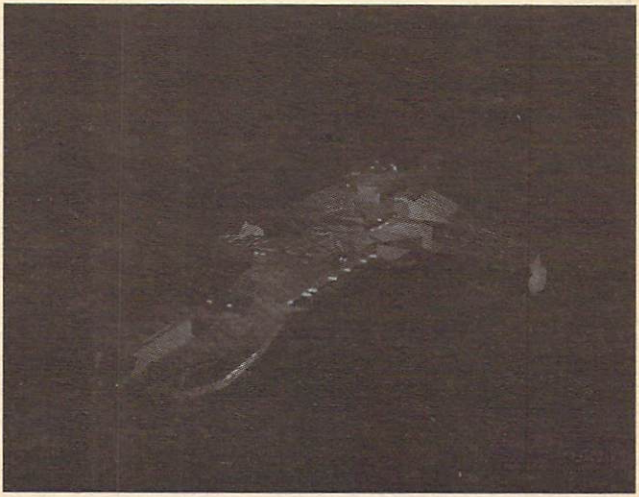
CLEAR – Resets the aimpoint and observer coords to the default settings.

PLAY – Starts animation playback in a continuous loop. To stop playback click the PLAY button again.

FRAME – Shows the current frame number.

EDITOR/SOLID – Moves to the Editor or Solid screens.

Solid Screen



This screen controls all of the settings used for rendering images and animations. The controls are as follows:

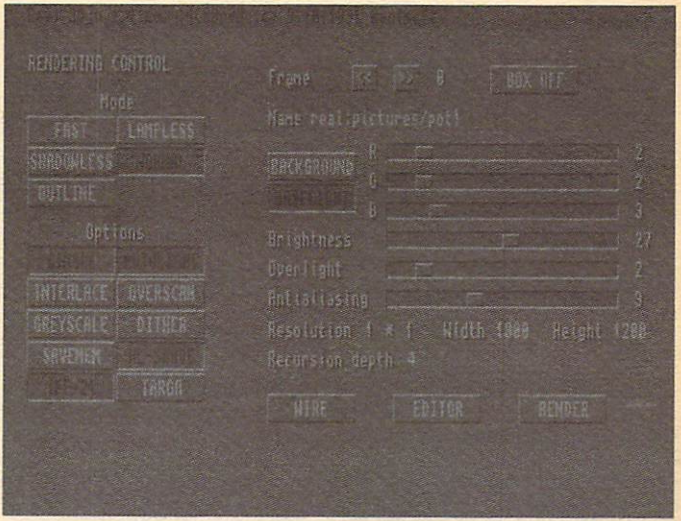
FRAME
You can move to any frame in the animation using the Frame field.

NAME
Use this field to define the path and filename to be used when rendering images – just click in this field and change it to any path you desire. If no path is set the images will be saved in the current directory.

BOX OFF
If a render box has been previously defined this button will delete it.

BASELIGHT
Defines the colour and brightness of the ambient light for the rendered image. The more baselight the less contrast in the final image.

BACKGROUND
Defines R,G,B values for the background colour of the scene. The background is rendered wherever an object is



All your final rendering is done via the Solid screen. The key to good results is knowing what the options do and when to use them.

not present. The background colour is also used as the default reflection for all object whose material has some brillancy and where no other object is reflected.

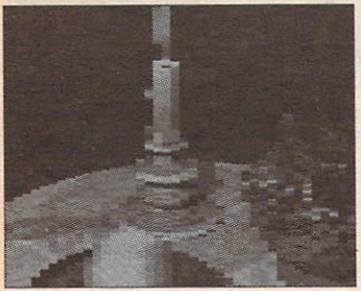
BRIGHTNESS

Sets the global brightness for all light sources. Use this

slider for control over how bright a scene will be rendered.

OVERLIGHT
Controls how bright the highlights on objects will be. If Overlight=0 then an object will never get brighter than it's actual colour. By increasing the Overlight shiny surfaces can be simulated without the high rendering times of reflective materials.

ANTI-ALIASING
Defines how well the scene will anti-aliased. This function smooths out jagged edges in the picture, the higher the setting the smoother the scene and the longer it will take to render.



Using blocky pixels, the render time is faster, and you still get an image.

RESOLUTION
The default of 1*1 means uses normal screen resolution. Increasing the values means larger and larger pixels are used, up to 8*8. The image quality is reduced but render times are halved with each increase in pixel size which makes this a useful tool for

rendering quick previews of a scene.

WIDTH AND HEIGHT.
Defines the output image size in pixels. You can set these to whatever values you desire. Even really large images, larger than any screen size) can be used, as long as you have enough memory and disk space.

RECURSION DEPTH
Defines how many times a ray of light can bounce of surfaces in the scene. This field only has an effect when transparent and reflective objects are present. The higher the setting the more the rendering time will be increased. It is worth using values of 5 or 6 if you have a number of transparent objects in a scene.

FAST MODE
This is the fasting rendering mode available, no materials are used and a only a single light source is used. The light source is always placed at the observer regardless of light sources in the scene.

NORMAL MODE
This is the highest quality rendering mode. Shadows, reflections, refraction, and all light sources are used. If you have not created a lamp in your scene, don't render with

this mode - all you'll get is black!

SHADOWLESS MODE
This is the same as Normal mode except no shadows are calculated which speeds up the rendering process considerably.

LAMPLESS MODE
This is similar to Fast mode but materials and reflections are considered, again only a single light source is used.

OUTLINE MODE
This renders the scene using a 2 colour outline of all the objects. This mode is good for producing wireframe preview animations as the 2 colour images require very little memory and render fairly quickly.

SINGLE
When working on an animation this tells REAL 3D to only render the current frame not the entire animation.

AUTOLIGHT
When set REAL 3D will use automatic scaling of each light source. The scaling is calculated to maintain a correct level of light falling on the origin.

INTERLACE, OVERSCAN, GREYSCALE
These buttons each define the type of screen mode to be used when rendering.

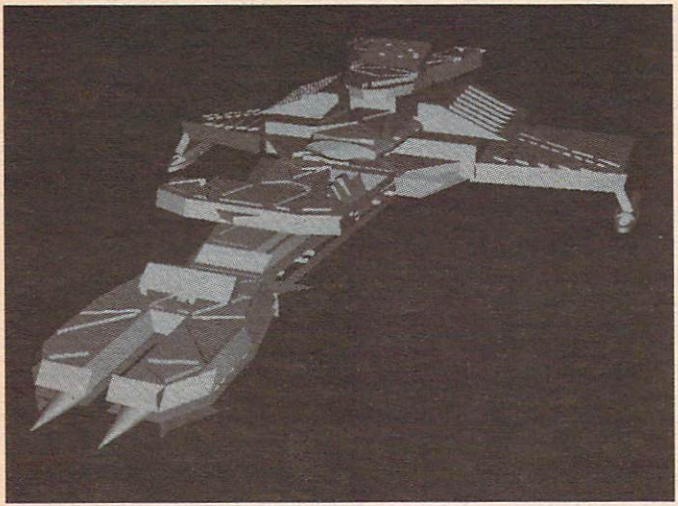
This is the sort of shading you'll get in standard greyscale mode.

DITHER
Turns dithering on which improves the image quality by mixing the available colours to give the impression of greater colour bandwidth. The type of dithering can be defined in the dither menu.

This is the same object, but with dithering enabled.

HL-SHADE
Tells REAL 3D to only use pure colours when rendering. By default this option is off and REAL 3D will use proportional scaling of the colours. HL-Shade will add contrast to the scene and will help reduce fringing in HAM modes.

With HL shading and dithering, the curve is smother (especially in colour).



A Fast or Lampless render will give faster results, but the objects are all harshly lit. Good for checking on work in progress though.

SAVEMEM
This tells REAL 3D to leave at least 150k of CHIP memory free but could slow down rendering.

TARGA / IFF
These buttons define what kind of image format to use

when rendering to a file, both output a 24bit image. Note that you cannot render a 24-bit image in Fast mode. Also, when using these options you will not get a screen display showing the rendering progress. Instead a percentage complete figure will be displayed just above the Render button.

FRAME COMMAND
Allows a Shell command to be executed after each frame of an animation is rendered. This is useful for single-frame recording devices and other similar hardware.

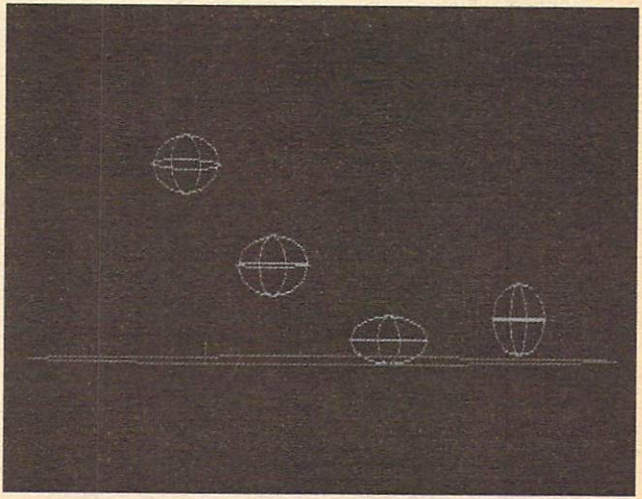
ASPECT RATIO.
Defines the aspect ratio used when rendering the image. The most common ratios are
640x256=2
640x512=1
320x512=0.5
640x480=1.0667
640x400=1.28
800x600=1.0667

RENDER
Starts the rendering process. If you are rendering a 24-bit image to disk, an indicator will show, in terms of percentage, how complete the image is. Note that some

parts of the image may be quicker to render than others, so if the indicator says 10% completed after 1 minute, it does not follow that it will be finished completely in 10 minutes.

EDITOR, AND WIRE
Exits the Solid screen and returns to either to Editor or Wireframe screens.

Animation

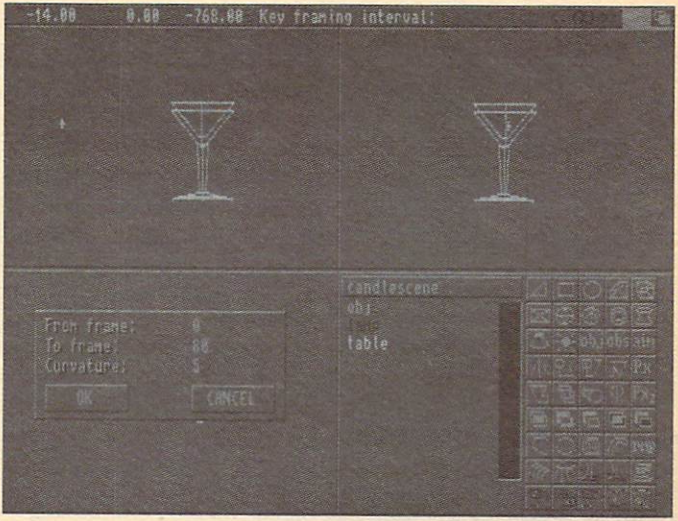


REAL 3D has several different ways of animating objects but possibly the easiest to use is the orbit function. Orbits allow you to define a path that the object will follow over a specified number of frames. To see how easy the orbit function is try the following:

- Create a simple object such as a sphere.
- With the object selected choose Project>Animation>Orbit from the menu.
- Next draw a path in one of the view windows for the object to follow.
- To complete the path click the right mouse button.
- A requester will appear asking for the start and end frames numbers for the orbit. Enter 0 and 50 and click on OK.

REAL 3D will now calculate a smooth orbit for the object. Go to the Wireframe screen and click on the play button. You will see a wireframe preview of the object following its path.

A more flexible method for applying orbits to to use a pre-defined path. This means the path can be drawn and edited in all 3 view windows before it is used as an orbit. To use the path for the orbit do the following:



It is important to get to grips with paths, orbits and directions if you want to generate animations successfully.

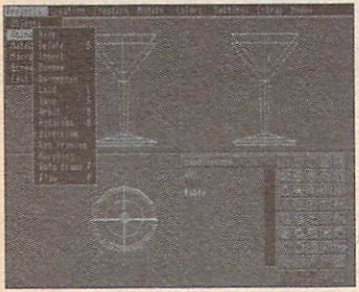
- Select the target object
- Use the menu Project > Animation > Orbit
- Press the * key on the numeric keypad
- REAL 3D now asks for the orbit line to be selected so find it in the Select window and click on the OK button at the bottom.

REAL 3D will then use the pre-defined curve for defining the orbit.

This is the probably the quickest way to animate an object in REAL 3D but of course the more complex methods allow greater control over the animation.

DIRECTION

Having given an orbit to an object the Direction tool can be used to make the object rotate as it follows the path. In order to do this make sure the object is rotated correctly to follow the orbit before applying the initial orbit. REAL 3D doesn't know which way an object should point and so it will always assuming the object is orientated correctly when the Direction tool is applied.



The Animation menu contains all the major functions you need.

ROTATION

Applying a rotation to an object works in a similar to the orbit tool expect instead of a path REAL 3D requires a mouse click in a view window to define the

centre of the rotation. A window will then appear asking for the start/end frames and angle of rotation. An angle of 360 will produce one revolution and 720 would produce two.

Note that rotation should be applied before an orbit or the centre of rotation will be incorrectly placed on all frames except the first.

MORPHING

REAL 3D is capable of using it's keyframe animation features to effectively "morph" an object, or in other words, to seemlessly transform one representation of an object into an altered representation. Let's have a look at this.
By default REAL 3D animations have only 1 frame, to add more frames the menu Project > Animation > Size is used. REAL 3D will then ask for a new size and add the frames to the end of the animation. Once the animation has more than one frame we can start to define keyframes for the object being morphed. To do this we need to first Expose the object in frame one. Exposing an object tells REAL 3D that the current frame should be a keyframe for the object. To Expose an object for any given frame simply select the object and correct frame number and click on the (X) button on the title bar. Now let's animate the sphere using morphing.

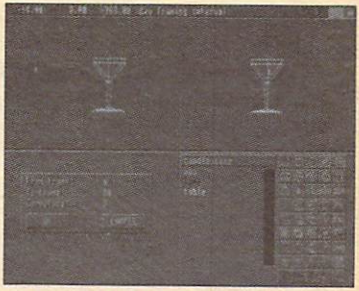
EXPOSE THE SPHERE ON FRAME ONE
Move to frame 24 using the forward button '<' to the right of the Expose button.
Expose the sphere in frame 24 and then move it to a new position. You can use any of the modification tools to stretch, rotate, etc. the sphere.
Go to the last frame of the animation, frame 49 and again expose the object.
Again modify the object to define the final keyframe.

To perform the morph use the menu Project > Animation > Morphing. A requester will ask for the start and end frames for the morph and and curvature parameter. For this example use 0, 49, and 5. The curvature parameter defines how the object moves between keyframes. The default value of 5 produces smooth motion, a value of 0 will give linear movement with rapid changes in direction and speed. Large values such as 15 will give exaggerated movement and may even produce extra loops between keyframes. Later on try this example again with different curvature values to see the different effects.

The morph is now complete, when REAL 3D calculated the morph it looked at each frame the morph was to happen over and used any frame the target object was exposed in as a keyframe. In the example we used 3 keyframes at 0, 24,

and 49 so REAL 3D will morph 0 to 24 to 49.

Note that morphing and keyframing will only work with objects that are the same. You cannot morph a sphere to a cube but could morph a sphere to an ellipsoid. Meshes offer more flexibilty for morphing as each point on the mesh can be edited for the morph.



It is possible to de-expose specific frames if you want to change or alter them.

DE-EXPOSING

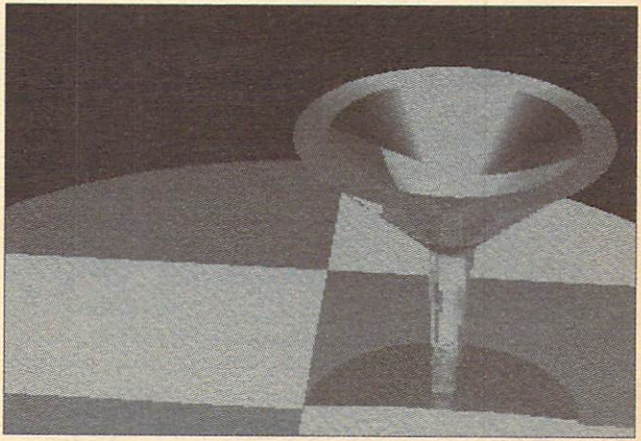
After performing a morph, orbit, etc. the target object will be exposed on every frame the animation tool was asked to use. If you aren't happy with the results there are two ways to change the animation .

The first is to simply go to the frames to be changed and edit the object. As the object is already exposed the changes are instant.

The second technique is to re-animate the object using the animation tools. Before you can do this you need to de-

expose all frames for the object except the keyframes. To do this use the menu Project > Animation > De-expose and REAL 3D will ask the number of frames to be de-exposed. The function starts from the current frame so be sure you are at the correct frame before using it.

Appendices



KEY	FUNCTION
a	Rotate
s	Size
d	Delete
f	Colour
g	Stretch
h	Mirror
j	Explode
k	Move to
l	Locate (to a new level)
x	Extend
c	Clone
v	Painting, define a line representing the size of the material's texture
b	Apply a material
n	Name
m	Move
+, -	Zoom in/out
.	Centre display on cursor
>	Autofocus on selected object
O	Reset display to defaults
enter	Redraw display
1-9	Preset grids
0	Turn off grid
G	Grid wireframe on/off
L	Load Project

S	Save Project
D	Delete Project
F	Goto Frame
P	Preview animation in editor
U	Undo
i	Object info
!	Re-calculate the wireframe of a boolean operation
r	Redo
(	Start macro recording
)	End macor recording
e	Execute macro once
$	Out of memory recovery
Esc	Cancel current function
space	Select object by mouse click, picks nearest object.
p	Select the parent of current object in select window
w	Go to the Wireframe screen
q	Go to the Solid Screen

DISPLAY
When REAL 3D saves an image the default tool is set to this image viewing program so when you double click on the icon for the picture Display will be run to show the image. Display can show 24bit Targa images by converting them to HAM.

DELTACONVERT
This program will build a REAL 3D DELTA animation from a series of IFF images.
To do this run the program and supply the following information:

Type of compression, Small Delta, or Fast Delta, or Anim5.
Filename to save the animation as.
First image filename (minus the frame index)
Starting frame index.
Final frame index.

Deltaconvert will now process each image in turn and compile the animation. When completed you can chose to add another sequence of images or click on ALL DONE to complete the conversion.

DELTAPLAY
This program will play animations created by Deltaconvert.

All animations created in Delatconvert will have Deltaplay set as the default tool in their icons. To stop the playback of an animation in Deltaplay press 'q' followed by return.

SCULPT TO REAL

Converts Sculpt 3D data files into REAL 3D format. It is possible to convert the Sculpt file into a point-editable primative or seperate triangles, the latter requiring much memory.

Aimpoint	The position in the 3D world of he software towards which the virtual camera is pointing.
Antialiasing	A shading technique which removes the hard edges on objects, by graduating the brightness between the edge and it's background
Boolean	A type of logic often used in the algebra of sets. It is used in REAL 3D to describe tools which apply logical operations to objects.
De-expose	An action which allows the software to forget that it has already rendered a number of images in an animation.
Dither	A way of fooling the eye into seeing more detail and a less severe blending of one colour into another. Dithering does increase rendering time however.
Keyframe	A frame in an animtion where all the objects and views have been placed manually. Real 3D will automatically calculate these positions in the frames between each keyframe.
Mesh	An object consisting of curves through a set of points. Meshes are usually

	generated using one of the sweep functions.
Morphing	A process in animation where an object is distorted into another shape semmlessly over a period of frames.
Observer	The position in three dimensional space at which the virtual camera is located.
Render	This is the name given to the process by which the software generates an image from the objects and their positions.
Spline curve	A curve mathematically generated to produce a gradual sweep hrough or around a number of defined points.

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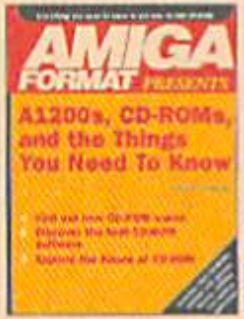

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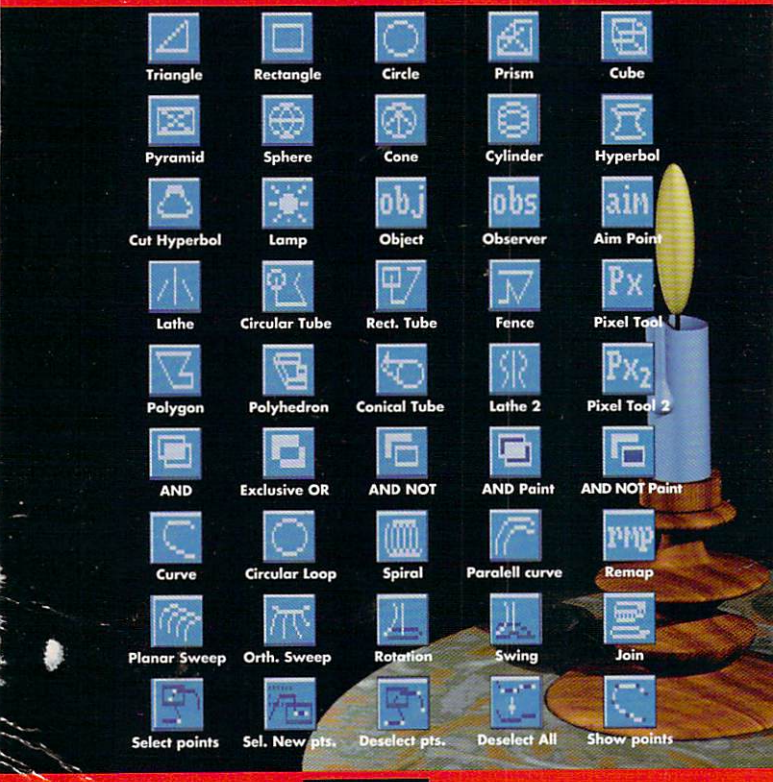

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